Systems & Matrices Practice
W/O Graphing Calculator

Name: Answer

1. Solve the system:
$$\begin{cases} 3x+y-z=-6 & ① \\ -x+2y+3z=-1 & ② \\ 5x-2y+6z=54 & ③ \end{cases}$$

(2, -7, 5)

$2+3$
$-x+2y+3z=-1$
$5x-2y+6z=54$
$4x+9z=53$

$2(1)+3$
$6x+2y-2z=-12$
$5x-2y+6z=54$
$11x+4z=42$

$11x+4z=42)-9$
$4x+9z=53)4$
$-99x-36z=-378$
$16x+36z=212$
$-83x=-166$
$x=2$

$11(2)+4z=42$
$22+4z=42$ $4z=20$ $z=5$

$-2+2y+3(5)=-1$
$2y+13=-1$
$2y=-14$
$y=-7$

Perform the indicated operation.

2. $\begin{bmatrix} -6 & 7 \\ 0 & 3 \end{bmatrix}+\begin{bmatrix} -6 & 2 \\ -8 & 1 \end{bmatrix}$

$\begin{bmatrix} -12 & 9 \\ -8 & 4 \end{bmatrix}$

3. $-\frac{2}{3}\begin{bmatrix} -9 & 3 \\ 4 & -1 \end{bmatrix}$

$\begin{bmatrix} 6 & -2 \\ -\frac{8}{3} & \frac{2}{3} \end{bmatrix}$

4. $\begin{bmatrix} 10 & 17 & -9 \\ -6 & 4 & 11 \end{bmatrix}-\begin{bmatrix} -6 & 8 & -2 \\ -4 & -9 & 4 \end{bmatrix}$

$\begin{bmatrix} 16 & 9 & -7 \\ -2 & 13 & 7 \end{bmatrix}$

5. $\begin{bmatrix} 4 & 1 \\ -3 & 0 \end{bmatrix}\begin{bmatrix} -7 & 5 \\ 7 & -3 \end{bmatrix}$

$\begin{bmatrix} -28+7 & 20+-3 \\ 21+0 & -15+0 \end{bmatrix}$

$\begin{bmatrix} -21 & 17 \\ 21 & -15 \end{bmatrix}$

6. $\begin{bmatrix} -16 \\ 2 \end{bmatrix}\begin{bmatrix} 4 \\ 15 \end{bmatrix}$

Can not multiply b/c column matrix ≠ row matrix 2

not defined

7. $\begin{bmatrix} 5 & -1 & 0 \\ 4 & -2 & 9 \end{bmatrix}\begin{bmatrix} 12 \\ -7 \\ 3 \end{bmatrix}$

$\begin{bmatrix} 60+7+0 \\ 48+14+27 \end{bmatrix}=\begin{bmatrix} 67 \\ 89 \end{bmatrix}$

Find the determinant of the matrix.

8. $\begin{bmatrix} 5 & 8 \\ -2 & 10 \end{bmatrix}$

$50--16$
(66)

9. $\begin{bmatrix} 1 & -3 & -2 \\ 7 & 4 & 0 \\ -7 & 2 & 3 \end{bmatrix}$ $\begin{matrix} 1 & -3 \\ 7 & 4 \\ -7 & 2 \end{matrix}$

$(12+0+-28)-(-56+0+-63)$
$(-16)-(-7)$
-9

-9

Find the inverse of the matrix.

10. $\begin{bmatrix} 3 & 7 \\ 3 & 8 \end{bmatrix}$

$24-21=3$

$\frac{1}{3}\begin{bmatrix} 8 & -7 \\ -3 & 3 \end{bmatrix} = \begin{bmatrix} \frac{8}{3} & -\frac{7}{3} \\ -1 & 1 \end{bmatrix}$

11. $\begin{bmatrix} 13 & 7 \\ -11 & -4 \end{bmatrix}$

$-52--77$

$\frac{1}{25}\begin{bmatrix} -4 & -7 \\ 11 & 13 \end{bmatrix} = \begin{bmatrix} -\frac{4}{25} & -\frac{7}{25} \\ \frac{11}{25} & \frac{13}{25} \end{bmatrix}$

12. $\begin{bmatrix} -2 & -5 \\ 4 & 10 \end{bmatrix}$

$-20--20=0$

Inverse not defined b/c inverse is zero

13. Solve the system using Cramer's Rule AND Inverse Matrices:

$2x+y=-8$

$-5x-2y=13$

Cramer's

$\begin{vmatrix} 2 & 1 \\ -5 & -2 \end{vmatrix} = -4--5=1$

$x: \frac{\begin{vmatrix} -8 & 1 \\ 13 & -2 \end{vmatrix}}{1} = \frac{16-13}{1} = 3$ $(x=3)$

$y: \frac{\begin{vmatrix} 2 & -8 \\ -5 & 13 \end{vmatrix}}{1} = \frac{26-40}{1} = -14$ $(y=-14)$

Inverse

$\frac{1}{1}\begin{bmatrix} -2 & -1 \\ 5 & 2 \end{bmatrix} = \begin{bmatrix} -2 & -1 \\ 5 & 2 \end{bmatrix}$

$\begin{bmatrix} 2 & 1 \\ -5 & -2 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -8 \\ 13 \end{bmatrix}$ (1)

$A^{-1}A\begin{bmatrix} x \\ y \end{bmatrix} = A^{-1}\begin{bmatrix} -8 \\ 13 \end{bmatrix}$

$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ -14 \end{bmatrix}$

14. Solve the matrix equation: $\begin{bmatrix} 2 & -3 \\ -5 & 7 \end{bmatrix}X = \begin{bmatrix} 4 & 6 \\ 0 & -1 \end{bmatrix}$

$14-15=-1$

$\frac{1}{-1}\begin{bmatrix} 7 & 3 \\ 5 & 2 \end{bmatrix} = \begin{bmatrix} -7 & -3 \\ -5 & -2 \end{bmatrix}$

$\begin{bmatrix} -7 & -3 \\ -5 & -2 \end{bmatrix}\begin{bmatrix} 2 & -3 \\ -5 & 7 \end{bmatrix}X = \begin{bmatrix} -7 & -3 \\ -5 & -2 \end{bmatrix}\begin{bmatrix} 4 & 6 \\ 0 & -1 \end{bmatrix}$

$X = \begin{bmatrix} -28 & -39 \\ -20 & -28 \end{bmatrix}$

15. Solve for x and y: $2\left(\begin{bmatrix} 2x & -3 \\ 5 & -y \end{bmatrix}+\begin{bmatrix} -1 & 4 \\ 3 & 5 \end{bmatrix}\right)=\begin{bmatrix} 10 & 2 \\ 16 & 14 \end{bmatrix}$

$x: 2(2x-1)=10$

$4x-2=10$

$4x=12$

$x=3$

$y: 2(-y+5)=14$

$-2y+10=14$

$-2y=4$

$y=-2$

16. Solve for x and y: $\begin{bmatrix} 4 & 1 & 3 \\ -2 & x & 1 \end{bmatrix}\begin{bmatrix} 9 & -2 \\ 2 & 1 \\ -1 & 1 \end{bmatrix} = \begin{bmatrix} y & -4 \\ -13 & 8 \end{bmatrix}$

$-2(9)+x(2)+1(-1)=-13$

$-18+2x-1=-13$

$-19+2x=-13$

$2x=6$

$x=3$

$4(9)+1(2)+3(-1)=y$

$36+2+-3=y$

$35=y$

Systems & Matrices Practices With Graphing Calculator

Name: Answers

1. Solve the system using inverse matrices. Show the setup and do the work on gc.

$$-6x+y+9z=4$$
$$2x-3y-z=-6$$
$$8x+5y-4z=10$$

$$\begin{bmatrix}-6 & 1 & 9\\ 2 & -3 & -1\\ 8 & 5 & -4\end{bmatrix}\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}4\\-6\\10\end{bmatrix}$$

A

$$A^{-1}A\begin{bmatrix}x\\y\\z\end{bmatrix}=A^{-1}\begin{bmatrix}4\\-6\\10\end{bmatrix}$$

$$\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}1/6\\2\\1/3\end{bmatrix}$$

2. Solve the system using Cramer's Rule. Show set up and do work on gc.

$$\begin{vmatrix}2 & -2 & -3\\ 3 & 0 & 1\\ 1 & 1 & 0\end{vmatrix}=-13$$

$$2x-2y-3z=9$$
$$3x+z=10$$
$$x+y=0$$

$(3,-3,1)$

$$z:\frac{\begin{vmatrix}2 & -2 & 9\\ 3 & 0 & 10\\ 1 & 1 & 0\end{vmatrix}}{-13}=\frac{-13}{-13}=1$$

$$x:\frac{\begin{vmatrix}9 & -2 & -3\\ 10 & 0 & 1\\ 0 & 1 & 0\end{vmatrix}}{-13}=\frac{-39}{-13}=3$$

$$y:\frac{\begin{vmatrix}2 & 9 & -3\\ 3 & 10 & 1\\ 1 & 0 & 0\end{vmatrix}}{-13}=\frac{39}{-13}=-3$$

Write a system and then use inverse matrices or Cramer's Rule to solve the problem.

3. The cost of 14 gallons of regular gasoline and 10 gallons of premium gasoline is $46.68. Premium costs $0.30 more per gallon than regular. What is the cost per gallon of each type of gasoline?

x = regular
y = premium

$14x+10y=46.68$
$y=x+.30$
$-x+y=.30$

$$\begin{bmatrix}14 & 10\\ -1 & 1\end{bmatrix}\begin{bmatrix}x\\y\end{bmatrix}=\begin{bmatrix}46.68\\.30\end{bmatrix}$$

A

$$\begin{bmatrix}x\\y\end{bmatrix}=A^{-1}\begin{bmatrix}46.68\\.30\end{bmatrix}$$

$$\begin{bmatrix}x\\y\end{bmatrix}=\begin{bmatrix}1.82\\2.12\end{bmatrix}$$

- One gallon regular = $1.82
- One gallon premium = $2.12

4. For opening day of a carnival, 800 admission tickets were sold. The receipts totaled $3775. Tickets for children cost $3 each, tickets for adults cost $8 each, and tickets for senior citizens cost $5 each. There were twice as many children's tickets sold as adult tickets. How many of each type of ticket were sold?

X = Children
y = Adult
z = Senior citizen

$x + y + z = 800$

$3x + 8y + 5z = 3775$

$x = 2y \Rightarrow x - 2y = 0$

$$\begin{vmatrix} 1 & 1 & 1 \\ 3 & 8 & 5 \\ 1 & -2 & 0 \end{vmatrix} = 1$$

$$x: \frac{\begin{vmatrix} 800 & 1 & 1 \\ 3775 & 8 & 5 \\ 0 & -2 & 0 \end{vmatrix}}{1} = \frac{450}{1} = 450$$

$$y: \frac{\begin{vmatrix} 1 & 800 & 1 \\ 3 & 3775 & 5 \\ 1 & 0 & 0 \end{vmatrix}}{1} = \frac{225}{1} = 225$$

$$z: \frac{\begin{vmatrix} 1 & 1 & 800 \\ 3 & 8 & 3775 \\ 1 & -2 & 0 \end{vmatrix}}{1} = \frac{125}{1} = 125$$

- 450 children
- 225 adults
- 125 senior citizens

5. On a certain river, a motorboat can travel 34 miles per hour with the current and 28 miles per hour against the current. Find the speed o the motorboat in still water and the speed of the current.

x = boat speed
y = current

$x + y = 34$

$x - y = 28$

$$\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 34 \\ 28 \end{bmatrix}$$

A

$$A^{-1} \cdot A \begin{bmatrix} x \\ y \end{bmatrix} = A^{-1} \begin{bmatrix} 34 \\ 28 \end{bmatrix} \quad \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 31 \\ 3 \end{bmatrix}$$

Boat speed: 31 mph
Current speed: 3 mph

Solve the Problem

6. A company manufactures three models of flat-screen color TVs: 1 19-inch model, a 27-inch model, and a 32-inch model. The TVs are shipped to two warehouses. The number of units shipped to each warehouse are given in matrix A, and the prices of the models are given in matrix B. Write a matrix that gives the total value of the TVs in each warehouse.

Matrix A

	19 in.	27 in.	32 in.
Warehouse 1	5,000	6,000	8,000
Warehouse 2	4,000	10,000	5,000

Matrix B

	Price
19 inch	$109.99
27 inch	$319.99
32 inch	$549.99

$$A \cdot B = \begin{bmatrix} 6,869,810 \\ 6,389,810 \end{bmatrix}$$

$6,869,810 in warehouse 1

$6,389,810 in warehouse 2

7. You are making a triangular pennant for your school football team. The vertices of the triangle are (0, 0), (0, 50), and (70, 20) where the coordinates are measured in inches. How many square inches of material will you need to make the pennant? How many square feet of material will you need?

$A = \frac{1}{2}\begin{vmatrix} 0 & 0 & 1 \\ 0 & 50 & 1 \\ 70 & 20 & 1 \end{vmatrix}$

$A = -\frac{1}{2}(-3500)$

$A = 1,750$

$1,750 in^2$

$\frac{1750}{144} \approx 12.153 ft^2$

8. A teacher is buying supplies for two art classes. For class 1, the teacher buys 24 tubes of paint, 12 brushes, and 17 canvases. For class 2, the teacher buys 20 tubes of paint, 14 brushes and 16 canvases. Each tube of paint costs $3.35, each brush cots $1.75, and each canvas cost $4.50. Organize the data in matrices to find the total cost of all the supplies?

$$\begin{matrix} \text{class 1} \\ \text{class 2} \end{matrix}\begin{bmatrix} 24 & 12 & 17 \\ 20 & 14 & 16 \end{bmatrix}\begin{bmatrix} 3.35 \\ 1.75 \\ 4.50 \end{bmatrix} = \begin{bmatrix} 177.9 \\ 163.5 \end{bmatrix}$$

$$\begin{matrix} P & B & C \end{matrix}$$

Total cost:
Class 1 $177.90
Class 2 $163.50

9. FInd two matrices such that $A \neq B$ and $AB = BA$

answer vary

10. $3X - \begin{bmatrix} 11 & -6 \\ 2 & 1 \end{bmatrix} = \begin{bmatrix} -13 & 15 \\ -19 & 2 \end{bmatrix}$

$+\begin{bmatrix} 11 & -6 \\ 2 & 1 \end{bmatrix} + \begin{bmatrix} 11 & -6 \\ 2 & 1 \end{bmatrix}$

$\frac{1}{3} \cdot 3X = \frac{1}{3}\begin{bmatrix} -2 & 9 \\ -17 & 3 \end{bmatrix}$

$X = \begin{bmatrix} -2/3 & 3 \\ -17/3 & 1 \end{bmatrix}$